

# FREQUENCY CONVERTER



## 1/3 RACK-MOUNTED BLOCK CONVERTER



Unit shown with Option 17

Unit shown without Option 17

### FEATURES

- Automatic 5/10 MHz internal/external reference selection with a 0.1 Hz nominal bandwidth clean-up loop
- Gain control
- RF and L-Band signal monitor ports (RF monitor not available with Ka-Band units)
- Low phase noise
- Low intermodulation distortion
- High-frequency stability
- Summary alarm
- Mute function on alarm or external mute input command
- LO frequency and power monitor
- CE certification

### OPTIONS

- High-performance package
- Higher frequency stability
- RS-422/RS-485 and 10/100 Base-T Ethernet
- LO level monitor
- Lower gain
- Amplitude slope control

This equipment is designed for applications where frequency translation is needed between L-Band and the transponder frequency.

U.S. Patent #7,510,090



# FREQUENCY CONVERTER

## BLOCK UPCONVERTERS

INPUT FREQUENCY (GHz)	OUTPUT FREQUENCY (GHz)	LO FREQUENCY (GHz)	MODEL NUMBER
0.95 to 1.525	5.85 to 6.425	7.375	UPB1-6.1TR-INV
0.95 to 1.75	5.85 to 6.65	4.9	UPB1-6.25TR
0.95 to 1.35	6.7 to 7.1	5.75	UPB1-6.9TR
0.95 to 1.45	7.9 to 8.4	6.95	UPB1-8.15TR
0.95 to 1.45	12.75 to 13.25	11.8	UPB1-13TR
0.95 to 1.7	13.75 to 14.5	12.8	UPB1-14.125TR
0.95 to 1.45	14 to 14.5	13.05	UPB1-14.25TR
0.95 to 2.05	17.3 to 18.4	16.35	UPB1-17.85TR*
0.95 to 1.25	18.1 to 18.4	17.15	UPB1-18.25TR

\* 1 GHz IF bandwidth

## Ka-BAND

INPUT FREQUENCY (GHz)	OUTPUT FREQUENCY (GHz)	LO FREQUENCY (GHz)	MODEL NUMBER
0.95 to 1.2	28.35 to 28.6	27.4	UPB1-28.475TR
0.95 to 1.45	29 to 29.5	28.05	UPB1-29.25TR
0.95 to 1.2	29.25 to 29.5	28.3	UPB1-29.375TR
0.95 to 1.7	29.25 to 30	28.3	UPB1-29.625TR
0.95 to 1.95	30 to 31	29.05	UPB1-30.5TR*
1 to 2	30 to 31	29	UPB1-30.5-1TR*

\* 1 GHz IF bandwidth



## BLOCK DOWNCONVERTERS

INPUT FREQUENCY (GHz)	OUTPUT FREQUENCY (GHz)	LO FREQUENCY (GHz)	MODEL NUMBER
3.4 to 4.2	0.95 to 1.75	5.15	DNB1-3.8TR-INV
3.4 to 4.2	0.95 to 1.75	8.85/11.3	DNB1-3.8TR
3.7 to 4.2	0.95 to 1.45	8.55/11.3	DNB1-3.95TR
7.9 to 8.5	0.95 to 1.55	6.95	DNB1-8.2TR
7.25 to 7.75	0.95 to 1.45	6.3	DNB1-7.5TR
7.25 to 7.95	0.95 to 1.65	6.3	DNB1-7.6TR
8.0 to 8.5	0.95 to 1.45	7.05	DNB1-8.25TR
10.7 to 11.7	0.95 to 1.95	9.75	DNB1-11.2TR*
10.95 to 11.7	0.95 to 1.7	10	DNB1-11.35TR
11.2 to 12	0.95 to 1.75	10.25	DNB1-11.6TR
11.45 to 12.25	0.95 to 1.75	10.5	DNB1-11.85TR
11.7 to 12.5	0.95 to 1.75	10.75	DNB1-12.1TR
11.7 to 12.75	0.95 to 2	10.75	DNB1-12.225TR*
12.2 to 12.75	0.95 to 1.5	11.25	DNB1-12.475TR
12.25 to 12.75	0.95 to 1.45	11.3	DNB1-12.5TR
12.75 to 13.75	0.95 to 1.95	11.8	DNB1-13.25TR
13.75 to 14.5	0.95 to 1.70	12.8	DNB1-14.125TR

\* 1 GHz IF bandwidth

## Ka-BAND

INPUT FREQUENCY (GHz)	OUTPUT FREQUENCY (GHz)	LO FREQUENCY (GHz)	MODEL NUMBER
17.7 to 18.7	0.95 to 1.95	16.75	DNB1-18.2TR
18.3 to 18.8	0.95 to 1.45	17.35	DNB1-18.55TR
18.7 to 19.7	0.95 to 1.95	17.75	DNB1-19.2TR
19.7 to 20.2	0.95 to 1.45	18.75	DNB1-19.95TR
20.2 to 21.2	0.95 to 1.95	19.25	DNB1-20.7TR*
20.2 to 21.2	1 to 2	19.2	DNB1-20.7-1TR*
28.3 to 28.8	0.95 to 1.45	27.35	DNB1-28.55TR
29.25 to 29.5	0.95 to 1.2	28.3	DNB1-29.375TR
29.25 to 30	0.95 to 1.7	28.3	DNB1-29.625TR
30.31 to 31	0.95 to 1.95	29.05	DNB1-30.5TR
30.31 to 31	1 to 2	29	DNB1-30.5-1TR

\* 1 GHz IF bandwidth

# FREQUENCY CONVERTER

SPECIFICATIONS	UPCONVERTERS	DOWNCONVERTERS
Input characteristics		
Return loss	18 dB minimum	20 dB minimum
LO leakage	N/A	-80 dBm maximum
Signal monitor	-20 dBc nominal	-20 dBc nominal
Output characteristics		
Return loss (50 ohms)	20 dB minimum, 18 dB for units above 22 GHz	18 dB minimum
Signal monitor	-20 dBc nominal	-20 dBc nominal
Power output (P1 dB)	+13 dBm minimum	+18 dBm minimum
Transfer characteristics		
Gain	30 dB, $\pm 3$ dB at 23 °C	35 dB, $\pm 3$ dB at 23 °C
Gain control	30 dB continuous adjust, rear panel control (0.2 dB steps with Option 17)	
Gain stability	$\pm 0.25$ dB/day maximum at constant temperature	
Amplitude response	$\pm 0.25$ dB/40 MHz maximum, $\pm 1$ dB maximum over RF frequency band	
Image rejection	60 dB minimum	60 dB minimum
Noise figure at minimum attenuation	15 dB maximum (20 dB for units above 22 GHz, 1 GHz IF bandwidth units)	
Intermodulation distortion (third-order)	With two inband signals at 0 dBm output, third-order intermodulation products are less than 60 dBc minimum (downconverters) and 50 dBc minimum (upconverters, and all Ka-Band units).	
Spurious outputs (inband)	65 dBc minimum up to 0 dBm output (including 2 x 1 spurious on 1 GHz IF bandwidth units) at maximum gain	
Signal-related		
Signal-independent	-75 dBm maximum	-75 dBm maximum
Phase noise	See graph on last page	See graph on last page
Frequency stability	$\pm 5 \times 10^{-8}$ , 0 °C to 50 °C (higher stability options available), $\pm 5 \times 10^{-9}$ /day typical (fixed temperature after 24 hours on time)	
Automatic reference configuration	External 5 or 10 MHz at +4 $\pm 3$ dBm. If external reference is below +1 dBm nominal, the converter will automatically lock to the internal reference. Reference oscillator acts as an analog phase lock with a 0.1 Hz nominal loop bandwidth. Typical loop suppression of the external reference is as follows: 28 dB at 1 Hz offset, 65 dB at 10 Hz offset, and 100 dB at 100 Hz offset (no reference suppression with Option 10F).	
Mute	60 dB minimum on summary alarm or mute command. Mute status and control illuminated keys and LCD display with Option 17.	
Indicator and alarms		
LO out-of-lock	Red LED (front panel)	
Internal reference	Amber LED (front panel)	
Power ON indicator	Green LED (front panel)	
Summary alarm	Contact closure status for DC voltage and local oscillator	

Note: All specifications at maximum gain unless otherwise noted.



## **GENERAL SPECIFICATIONS**

### **PRIMARY POWER REQUIREMENTS**

Voltage..... 100 VAC to 240 VAC (-10%, +6%)  
Frequency ..... 47 Hz to 63 Hz  
Consumption..... 12 W typical

### **PHYSICAL**

Weight..... 4.5 lb. [2.04 kg] nominal  
Dimensions..... 5.70" [144.8 mm] x 1.48" [37.6 mm] x 18" [457.2 mm] excluding connectors

#### **Rear-panel connectors**

RF-Band..... SMA female compatible  
L-Band ..... SMA female  
RF-Band monitor..... SMA female— not available with Ka-Band units  
L-Band monitor ..... SMA female  
External reference input ..... SMA female  
Status interface..... DE-9S  
Redundancy interface ..... DE-9P  
Remote interface (Option 17)..... RJ-45 female for Ethernet, RS-422/RS-485 available on status connector  
Primary power input ..... IEC-320

#### **Front-panel connectors**

LO monitor ..... SMA female

### **ENVIRONMENTAL**

#### **Operating**

Ambient temperature..... 0 °C to 50 °C  
Relative humidity..... Up to 95% at 30 °C  
Atmospheric pressure ..... Up to 10,000 feet

#### **Nonoperating**

Ambient temperature..... -50 °C to +70 °C  
Relative humidity..... Up to 95% at 45 °C  
Atmospheric pressure ..... Up to 40,000 feet  
Shock and vibration ..... Normal handling by commercial carriers

### **ACCESSORIES**

#### **1/3 rack-mount frame**

Model number ..... OL-TR3-20  
Weight..... 1.5 lb. [0.68 kg] nominal  
Dimensions ..... 19" [482.6 mm] x 1.75" [44.5 mm] x 20" [508.0 mm]

#### **Single-unit frame (includes rack slides)**

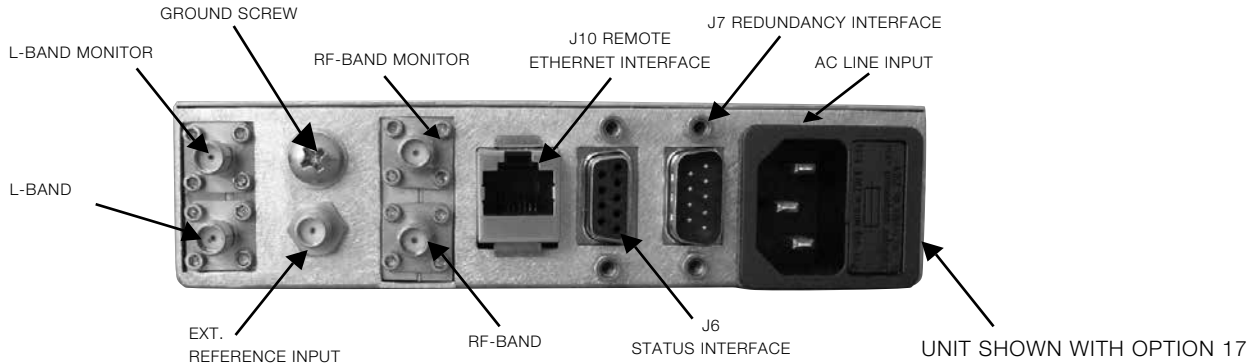
Model number ..... OL-TR1-20  
Weight..... 2 lb. [0.9 kg] nominal  
Dimensions ..... 19" [482.6 mm] x 1.75" [44.5 mm] x 18" [457.2 mm]

#### **Dual-unit frame (includes rack slides)**

Model number ..... OL-TR2-20  
Weight..... 3 lb. [1.35 kg] nominal  
Dimensions ..... 19" [482.6 mm] x 1.75" [44.5 mm] x 18" [457.2 mm]

# FREQUENCY CONVERTER

## TYPICAL REAR-PANEL VIEW



## OPTIONS

Missing option numbers are not applicable for this product.

### 1. High-performance package

- Power output (1 dB compression)..... +20 dBm minimum (+15 dBm minimum, Ka-Band upconverters)
- Gain slope..... 0.03 dB/MHz maximum
- Gain stability.....  $\pm 0.25$  dB/day maximum at constant temperature, 1.0 dB peak-to-peak maximum/0 °C to 50 °C
- Group delay ..... 1 ns peak-to-peak maximum
- Spurious outputs (inband)
  - Signal-related ..... 65 dBc minimum at 0 dBm output
  - Signal-independent ..... -80 dBm maximum
- Image rejection ..... 80 dB minimum
- Intermodulation distortion (third-order) ..... With two inband signals at 0 dBm output, third-order intermodulation products are less than 60 dBc minimum and 50 dBc minimum (Ka-Band upconverters).
- High-performance phase noise (dBc/Hz)(maximum)

#### OFFSET (Hz)

LO Frequency	10	100	1K	10K	100K/300K	1M
Up to 6.7 GHz	-54	-78	-108	-116	-119	-136
6.7 GHz to < 8 GHz	-53	-76	-107	-114	-117	-134
8 GHz to < 12 GHz	-48	-73	-103	-112	-115	-132
12 GHz to < 13.4 GHz	-48	-72	-102	-110	-113	-130
13.4 GHz to < 16 GHz	-47	-70	-100	-108	-111	-128
16 GHz to < 24 GHz	-42	-67	-98	-106	-109	-126
24 GHz to < 29.05 GHz	-41	-64	-94	-102	-107	-124

- Noise spectral density ..... -90 dBm/4 kHz maximum (upconverters below 18 GHz), -85 dBm/4 kHz maximum (downconverters and upconverters above 18 GHz)
- AM/PM conversion (at 0 dBm output) ..... 0.1°/dB maximum
- Upconverter mute ..... 80 dB minimum on summary alarm, external mute input control or remote command.

### 2. Lower gain ..... 20 $\pm$ 3 dB at 23 °C, 18 dB noise figure, 22 dB for 1 GHz IF bandwidth units, signal-related spurious -65 dBc at -5 dBm output.



## OPTIONS (CONTINUED)

Missing option numbers are not applicable for this product.

- 8. LO level alarm  
Summary alarm is generated for loss of power in any of the required local oscillators
- 10. High-frequency stability reference
  - C.  $\pm 5 \times 10^{-9}$ , 0 °C to 50 °C,  
1 x 10<sup>-9</sup>/day typical (fixed temperature after 24 hours on time)
  - F. High-frequency stability reference with direct phase lock to external reference input. No phase noise suppression on external reference input.  
 $\pm 5 \times 10^{-9}$ , 0 °C to 50 °C,  
1 x 10<sup>-9</sup>/day typical (fixed temperature after 24 hours on time)

Note: Converter may require 7 to 10 days to reach stability after long storage periods.
- 17. Remote control ..... 10/100 Base-T Ethernet interface providing:  
HTTP-based web server, SNMP 1.0 configuration, alarm reporting via SNMP trap telnet access, password protection and selectable RS-485/RS-422, gain control is 30 dB in 0.2 dB steps, alarm, reference and mute status on front panel
- \*21-1. Amplitude slope control..... Front panel and remote control of amplitude slope.  
Control range: 0 dB to 1 dB minimum 500 MHz IF BW, 0 dB to 1.5 dB minimum 800 MHz IF BW, 0 dB to 2 dB minimum 1000 MHz IF BW, 0 dB to 3 dB minimum 1500 MHz IF BW. Control step size: 0.2 dB
- \*21-2. Amplitude slope control..... Front panel and remote control of amplitude slope.  
Control range: 0 dB to 2 dB minimum 500 MHz IF BW, 0 dB to 3 dB minimum 800 MHz IF BW, 0 dB to 4 dB minimum 1000 MHz IF BW, 0 dB to 6 dB minimum 1500 MHz IF BW. Control step size: 0.2 dB

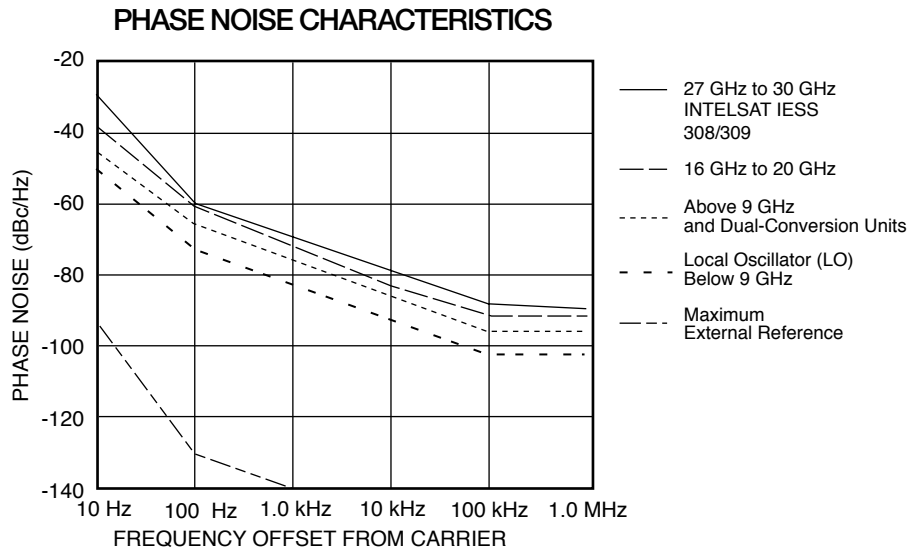
Notes: Amplitude response specifications are measured with linear components of slope equalization removed. Units are calibrated outside minimum range, however, minimum slope range provided as listed above. For Options 21-1 and 21-2, amplitude slope may be flat for 0 dB slope value.

\* Available with Option 17 only.

Note: For literature describing local control (front panel) and remote control (bus control), refer to L3 Narda-MITEQ Technical Note 25T066.

# FREQUENCY CONVERTER

## PHASE NOISE SPECIFICATIONS



The material presented in this datasheet was current at the time of publication. L3 Narda-MITEQ's continuing product improvement program makes it necessary to reserve the right to change our mechanical and electrical specifications without notice. If either of these parameters is critical, please contact the factory to verify that the information is current.

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